THE EFFECTS OF SNOWMOBILING ON WINTER RANGE USE BY MOUNTAIN CARIBOU

Ministry of Environment and Parks
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The Effects of Snowmobiling on Winter Range Use by Mountain Caribou

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INTRODUCTION

Snowmobiling is a popular recreational activity that can promote use and appreciation of wilderness areas. Snowmobiles are also an important tool for trappers and others who work in snow-covered areas. However, detrimental effects on wildlife populations by the increasing use of snowmobiles could occur and must be prevented.

Little information exists on the response of mountain caribou (Rangifer tarandus caribou) to human disturbances. Some information is available on the response of northern caribou to vehicles, aircraft and construction activities, and considerable data are available on the responses of deer to snowmobile use on their winter ranges.

Klein (1980) concluded that manmade linear features, such as roads, railroads, pipelines, power lines and artificial water courses, block, deflect or delay caribou movements. The level and type of vehicle traffic and other human activities associated with these features influence the reaction of caribou. Caribou avoid unfamiliar stimuli but, if found benign, they learn to ignore them (McCourt et al. 1974). Some activities, such as logging, actually attract caribou during periods when food is in short supply (Simpson et al. 1985). The response of caribou to human activities depends on the animals' previous experience and may vary from flight to habituation (Geist 1971).

The literature for deer is inconclusive. Some report that snowmobiling caused no changes in range, movements or population size of deer (Aune 1981; Eckstein et al. 1979). Others found increases in home range size and abandonment of high use snowmobiling areas (Dorrance et al. 1975; Kopischke 1972). Snowmobile use in some deer habitats may be beneficial in providing easy travel routes between feeding sites on packed trails (Richen and Lavigne 1978). In Yellowstone Park, deer, elk and bison adapted to snowmobile use by avoiding high use areas during the day and using them at night, when snowmobiles were not present (Aune 1981). Their dependence on snow-free geothermal areas for winter food and the lack of alternative feeding sites probably forced this adaptation. The varying results suggest that the reactions of deer to snowmobiling were unique to each study area.

Caribou have the largest home range of any North American ungulate. Most believe that caribou travel to find optimum habitat conditions (snow and forage) that are spatially separated (White et al. 1981) and to maintain spatial separation from predators (Bergerud et al. 1974). Movement and habitat use by caribou varies in different parts of North America but the requirement for space is universal.

Snowmobile use on caribou winter ranges causes losses of usable range and affects reproduction and survival. Disturbance can cause delayed death in large mammals (Young and Bronkhurst 1971) or disruption of cow-calf bonds and increased calf mortality (Shea 1979). Losses of range lead to reduced abundance by making caribou more vulnerable to their natural predators (Bergerud et al. 1974) and by increasing the cost of obtaining food (White et al. 1981). Activities that cause caribou to cross steep slopes in late-winter may cause many more avalanche mortalities (Simpson et al. 1985).

The purposes of this study were to determine:

1. if snowmobiling did affect the range use of caribou in the Revelstoke area;

2. what factors were important in determining the response of caribou to snowmobiling; and,

3. what level of snowmobile use, if any, was acceptable to caribou.

This study was funded by the British Columbia Ministry of Environment using funds provided by B.C. Hydro as partial compensation for wildlife losses resulting from the Revelstoke dam. The Revelstoke Snowmobile Club supported the voluntary snowmobile closures in portions of the study area. Guy Woods of the Wildlife Branch reviewed the manuscript.

STUDY AREA

The principal study areas were Frisby and Boulder ridges, subalpine areas near Revelstoke, B.C. (Fig.1). Both had rolling moderately sloped crests in the Engelmann spruce (Picea engelmannii) - subalpine fir (Abies lasiocarpa) parkland forest zone at the 1830 m (6000 ft.) elevation. The areas were characterized by open terrain interspersed with clumps of trees. This forest type is the preferred late-winter (February-April) habitat of mountain caribou (Simpson et al. 1985).

To asses caribou use, Frisby Ridge was divided into three sections. The southern section, 13 km^2 in area, was nearest the access route and was most heavily used by snowmobilers. The central section was also 13 km^2 and was moderately used by snowmobilers. The northern section was smaller (10 km^2) and was rarely used by snowmobilers. It was burned about 1940 and only one-third of the area was forested.

Approximately one-half of Boulder Ridge and all of Frisby Ridge were accessible to snowmobiles when snow conditions were good. Generally, most use was restricted to the areas on the ridge tops nearest the points of access and decreased further from the access trails. Both ridges had logging road, then trail, access to their summits. A snow-packing machine, belonging to the Revelstoke Snowmobile Club, was used to maintain access after heavy snowfalls.

Cabins were constructed on east Boulder in 1975 for snowmobilers and on south Frisby in 1975 for cross-country skiers. High elevation logging improved access to south Frisby in 1982 and a cleared trail for the snow-packer was established shortly thereafter.

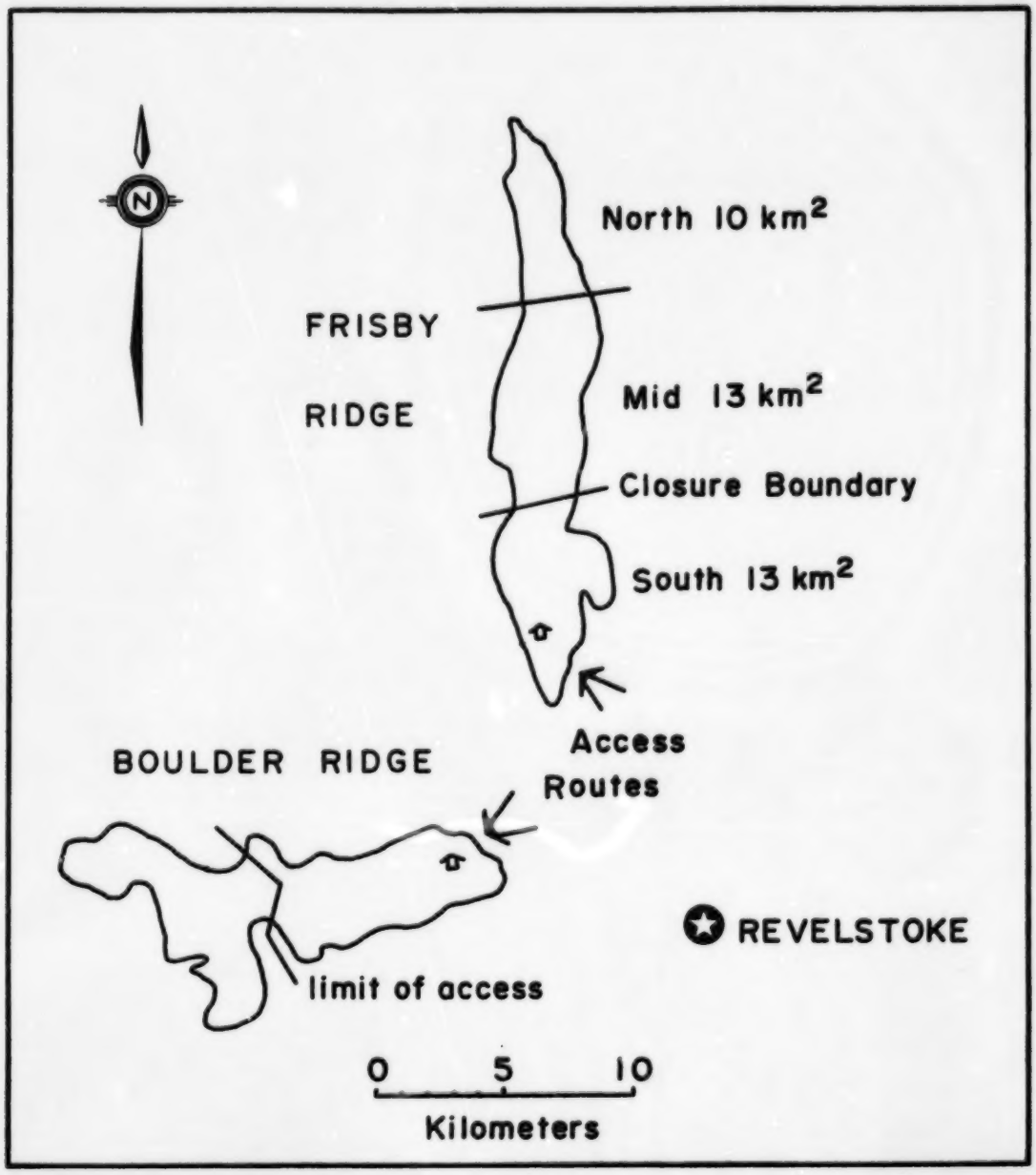

Figure 1. The study area showing the two alpine ridges near Revelstoke most frequently used by snowmobilers.

METHODS

Caribou use was recorded from 1981 to 1985 primarily for a habitat use study (Simpson et al. 1985). Snowmobile use was noted from 1981 to 1983 but was not consistently recorded or quantified. In 1984 and 1985, during weekly flights, areas of snowmobile activity were mapped. The number of machines using each area between flights or since the last snowfall was estimated from tracks. In 1985, snowmobile use on Frisby Ridge was also quantified using questionnaires placed at an information sign near the snowmobile unloading site. Information requested included the date, address, number/group and time out (Appendix A).

In 1984 and 1985, the central and northern sections of Frisby Ridge (Fig. 1) were closed to snowmobiling by voluntary agreement with the Revelstoke Snowmobile Club. The area of the closure was indicated on the information sign at the unloading site and the boundary was posted on the ridge. Other users, particularly helicopter skiers, were also asked not to use the closed area.

Snowmobile disturbance was introduced to several other ridges, not normally used by snowmobilers, when aerial locations indicated that caribou were present and accessible. Animals were approached, but never chased, in five different areas. Their response was noted directly, if the animals could be seen, or they were tracked after moving away. Twice I used radio telemetry equipment to track radio-collared animals to determine their response.

I compared caribou use and movements in areas of varying snowmobile use to assess the effects of snowmobiling on caribou. Direct observation of the response of caribou to snowmobiles was helpful in understanding the aspects of snowmobiling that disturbed caribou.

RESULTS

Caribou use on Boulder Ridge was not well documented prior to 1983. However, a private pilot, R. Humphrey, from Revelstoke had recorded caribou sightings in his flight log during eight flights in February or March between 1971 and 1974 (Table 1). Most sightings (63%) were in the meadow now occupied by the snowmobilers' cabin. In 1984 and 1985, only two caribou were seen in areas of Boulder regularly used by snowmobilers and none were seen in the meadow near the cabin. The snowmobile club members stated that they seldom saw caribou or their sign on Boulder Ridge.

Caribou use on Frisby Ridge averaged 15 animals each year, but, based on aerial surveys, a distinct shift in their distribution occurred from February to April (Table 2). From 1981 to 1983, most caribou were found at the south end of the ridge in February and gradually moved north (Fig. 2). By April, no animals remained on the south part of Frisby and over 50% were on the northernmost part of the ridge. Following the closure in 1984-85, most

caribou remained on the middle portion of the ridge throughout the season. Fewer animals used the south portion and their numbers again decreased to zero by April. Fifteen of the 21 animals seen in the south area during the closure were one group sighted 200 m south of the closure boundary. They were sighted the following day north of the boundary. The caribou distribution differed significantly before and after the closure ($X^2 = 100$, $p<.001$).

Forty-two percent of 76 observed snowmobile users signed in on Frisby Ridge. I estimated 417 users from January 8 to April 15 based on the 175 sign-ins. Users averaged 5.5 hours per trip. Eighty-three tracks were counted past the closure signs (20%) but only 23 of these went more than 2 km past the closure (6%). Most (75%) were local users on weekends (82% Friday- Sunday). The two largest groups of 45 and 27 were from Alberta, Saskatchewan, Nelson and Revelstoke.

Table 1. Historical and current caribou use on Boulder Ridge.

Years	No. of Flights	No. Animals or Tracks on Boulder	No. Seen in Other Areas
1971 - 1974	8	93	----
1984 - 1985	13	16	1071

Table 2. The numbers of caribou seen on Frisby Ridge during aerial survey flights before and after the snowmobile closure.

	Before closure				After closure			
	Feb	Mar 1-15	Mar 16-31	Apr	Feb	Mar 1-15	Mar 16-31	Apr
No. of Flights	6	9	9	4	5	5	3	3
No. Caribou Seen	15	59	99	24	26	34	44	29
No. Seen / Flight	2.5	6.5	11.3	6.0	5.2	6.8	14.7	9.7

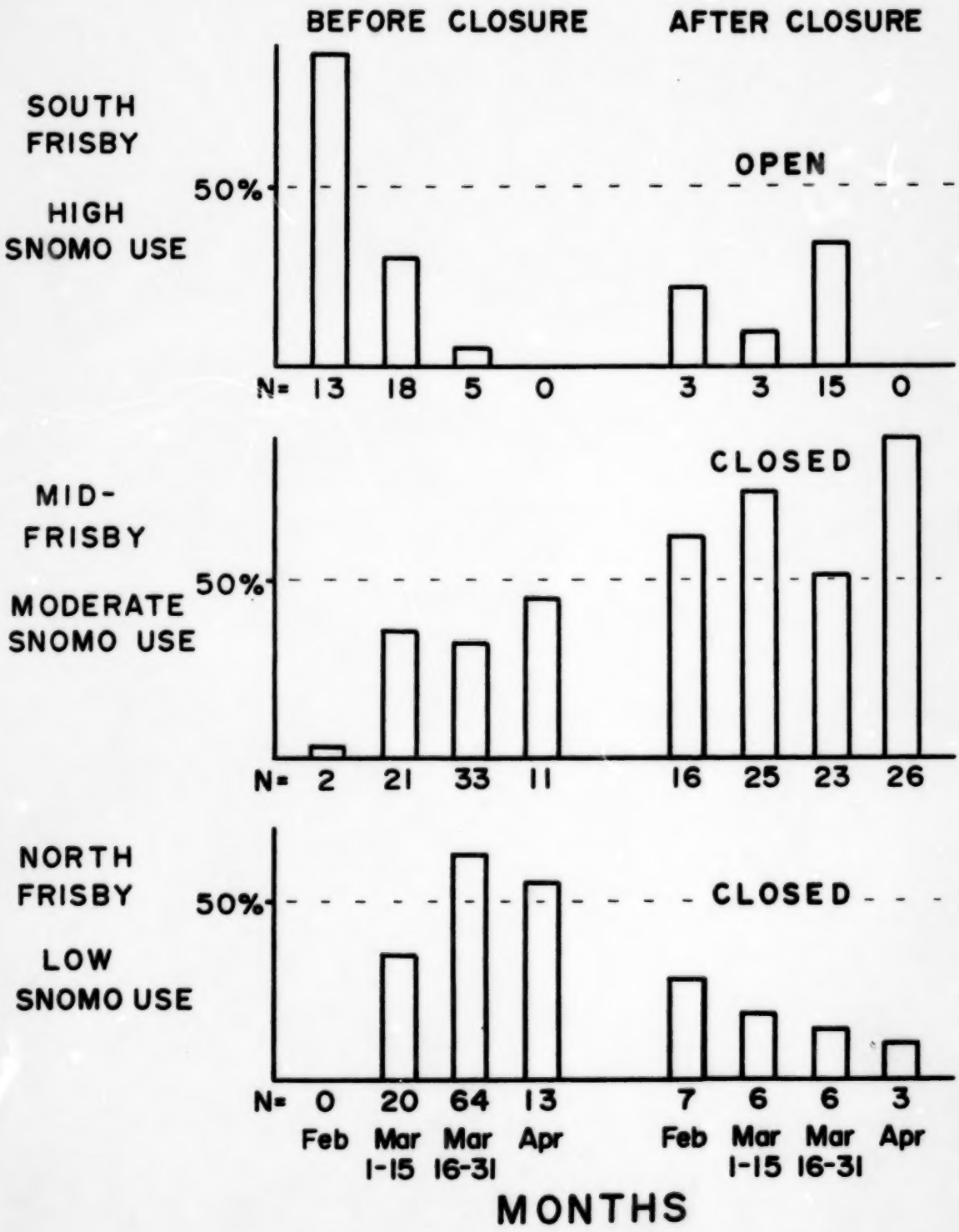

Figure 2. The percent distribution of caribou on Frisby Ridge before and after a voluntary snowmobile closure.

Snowmobile use on Frisby was quantified in hours per day based on questionnaire returns. Most use was in March or April (Table 3). Weather and snow conditions probably influenced the timing of use. Soft snow prevented access to the ridge since snowmobiles bogged down when climbing steep slopes. Dense cloud layers, which frequently formed at 1400 m (4500ft.), created white-out conditions and made navigation on the rolling alpine terrain difficult and dangerous.

Table 3. Snowmobile use on Frisby Ridge and weather, 1985.

Month	Snowmobile hours/day	Days without precipitation (%)
January	8	35
February	6	7
March 1-15	22	73
March 16-31	10	33
April	20	30

Groups of caribou were approached 18 times using either one or two snowmobiles. Seven groups ran away, eight walked away and three showed no reaction. No groups were approached closer than 100 m. Responses were related to three basic stimuli - scent, sight and sound. Assessing each approach independently, I judged that caribou had scented me on 4 approaches, heard me on 17 and saw me on 9. Caribou always ran away when they scented me (Table 4). Sound and sight most often caused caribou to walk away, although three groups showed no reaction and six ran (Table 4). Three of the six groups that ran away had also scented me.

The distance that caribou allowed an approach (flight distance) varied with the type of stimulus. Flight distances were shortest (x=139 m) when the animals saw me (Table 4). Scent and sound elicited successively greater flight distances. Sound alone was associated with the greatest flight distances (x=286 m). Caribou usually moved less than 1 km immediately after disturbance (x=0.6 $\pm$0.2, N=15) and, in all but one case, continued to use the area within 2 km of the disturbance site. The experimental disturbance by one or two machines never caused caribou to cross a valley or move to another ridge.

Table 4. Responses of groups of caribou to experimental snowmobile disturbance.

Stimuli	N	Flight Distance (m)	Response
sight, sound	7	136 ±28[a]	5-walk, 2-none
sight, sound, scent	2	150 ±50	2-ran
sound, scent	2	188 ±12	2-ran
sound	7	286 ±40	3-ran, 3-walk, 1-none

[a] mean ±SE.

DISCUSSION

Fewer caribou used Boulder Ridge in 1984 and 1985 than from 1970 to 1974. Construction of the chalet in 1975 and increasing use of the area by the Revelstoke Snowmobile Club were believed the causes for the absence of caribou. All aerial sightings of caribou in 1984-85 were near the margins of the snowmobiling area and probably resulted from animals approaching Boulder Ridge from areas not accessible to snowmobiles.

Caribou numbers on Frisby Ridge remained fairly constant although there was slightly higher use following the snowmobile closure (Table 2). The movement of caribou from south to north coincided with the increasing snowmobile use, largely on the south end of the ridge, from January to April. Following the closure, the reduced snowmobile use allowed more animals to remain on the central portion of the ridge. I expected more animals to use the central area because it was a larger area and had better quality habitat than the north ridge, which was mostly burned. Intensive use, which averaged 22 snowmobiling hours/day at its peak, caused caribou to move away from the south ridge. Bergerud (1984) stated that "...extreme and persistent harassment..." would be required to cause caribou to abandon preferred ranges. Apparently that level of disturbance was reached on the parts of Boulder and Frisby Ridges most often used by snowmobilers.

Caribou responses to experimental snowmobile disturbance appeared unpredictable. Many factors affect an animal's response to human disturbances. Most responses are related to learned or innate behaviour designed to avoid predators. Flight distances of prey species vary depending on the type of predator, season, habitat and the age, sex and physical condition of the animal (Walther 1969). Generally, prey species try to avoid predators without wasting energy. Responses are related to the level of threat perceived by the animal, based on previous experience, and their ability to locate and identify a disturbance. Sighting a snowmobiler may provide a level of security for caribou since they can assess the distance, direction and speed of the intruder and determine the potential danger (Moen et al. 1982; Aune 1981; Richen and Lavigne 1978). Caribou allowed the closest

approaches when they sighted the snowmobile. Caribou withdrew more quickly when people were scented because, in this hunted population, they have learned to avoid people. Sound, being an inexact stimulus, alerted caribou to an unnatural presence in their habitat but it does little to locate or identify the source. Sound elicited greater flight distances probably because caribou did not want a potential danger to approach too closely before being identified. The lack of information provided by a sound stimulus promoted more wariness in caribou. The general response to the sound of a snowmobile was a slow withdrawal. In three of six cases where animals ran, I was also scented. In two of three cases where animals showed no reaction, I was also seen. In summary, sound alerted caribou and made them withdraw, scent identified me and caused caribou to flee. Sight elicited the least response provided I was not scented, I stayed far enough away and I did not threaten the animals by approaching them directly and rapidly. The moderate response of caribou to snowmobile sounds indicated that animals did not associate snowmobiles with bad experiences.

The reasons that caribou avoided high use snowmobile areas related to the presence of human scent and the mobility of snowmobiles. My experience also showed that, even when animals were known to be present, they were sighted only 50% of the time. Possibly, large groups of snowmobilers roaming through an area may unintentionally "chase" animals (Moen et al. 1982). Being surrounded by fast moving sound stimuli may panic caribou because they are unable to locate multiple threats while scent initiates flight. Caribou are capable of locating and avoiding a few machines, whereas many machines may cause panic and lead to abandonment of an area.

The effectiveness of the voluntary snowmobile closure resulted from the degree of cooperation of local snowmobilers. Most users on Frisby Ridge were local residents and many of the visitors registered on the sign-on sheets were accompanied by local club members. I believe that a high degree of self-policing and advertising by the Revelstoke Snowmobile Club led to the high degree of compliance observed on Frisby Ridge.

The occurrence of other user groups on Frisby, particularly helicopter and cross-country skiers, was recorded. Helicopters are much more mobile than snowmobiles and, because caribou have been sensitized to helicopters by capture programs, helicopters have greater potential to disturb or harass caribou. Frisby Ridge was rarely used by heli-skiers because they preferred longer runs in other areas. Most heli-skiing was done on the north and middle parts of Frisby Ridge when other areas could not be reached due to poor weather. The steep slopes and avalanche paths on the west side of the ridge were the runs most commonly used. The moderately sloped ridge top was used only at five unloading sites. Helicopter skiers stayed close together so they could follow their guides to the pick-up sites in the valley bottoms. The limited time that heli-skiers spent in the favoured caribou habitat and the fact that groups stayed close together on defined routes reduced their potential to disturb caribou. Caribou continued to use areas where heli-skiing occurred, indicating that heli-skiing was not a major factor influencing the caribou distribution. Under the terms of the heli-skiing licences, helicopters must fly at least 500 m above the trees and they are not permitted to approach groups of animals.

The activities of cross-country skiers were confined mainly to the area

around their cabin on Frisby Ridge. Ski tracks were seen only once in the area immediately south of the closure boundary. Skiers probably contribute to the avoidance of south Frisby by caribou, but their limited occurrence and range were overshadowed by the extensive snowmobile use.

CONCLUSIONS

The present levels of snowmobile use on Boulder and Frisby Ridges are incompatible with continued occupancy of the areas by caribou. The aspects of snowmobiling most disturbing to caribou are human scent and large groups of machines moving rapidly around an area. Caribou can tolerate low levels of snowmobile use and, if they are not harassed by snowmobilers, their tolerance will probably increase.

RECOMMENDATIONS

The first objective of the B.C. Ministry of Environment and Parks should be to re-establish and maintain caribou use on the ridges near Revelstoke. To accomplish this, the level of snowmobile and other human uses must be reduced during the periods that caribou are normally present. Two factors are important in determining management options:

1. Caribou may continue to use areas as close as 0.5 km from intensive human activity

2. Caribou may habituate to <u>low levels</u> of non-harmful human activities that are <u>gradually</u> increased.

The partial closure on Frisby Ridge should be continued until such time that the level of caribou use on the south portion is equivalent to use on the mid- and northern portions. To reduce snowmobile use in the south area I suggest that the marked access trail be revegetated and the guiding flagging and other marks be removed. The trail packer should no longer be used. No more than 10 snowmobilers should use the ridge on any one day and total use should not exceed 100 machine hours / month from February to April. Information signs should be erected and maintained informing users of the closure areas and instructing people not to approach caribou, to stay downwind and to turn back if they encounter caribou or their tracks.

I suggest maintaining Boulder Ridge as the primary snowmobiling area near Revelstoke. Access problems associated with logging road use could easily be solved through negotiations among the logging companies, the Ministry of Forests and the Revelstoke Snowmobile Club. The currently difficult access to the western half of Boulder should not be altered so that caribou populations may be maintained adjacent to this high use area and

thereby increase the potential for habituation. It should be recognized that permitting unlimited use on Boulder Ridge represents a substantial sacrifice of prime caribou winter range and contradicts the Specific Use Permit (SUP) granted in 1975, which stated that the proposed snowmobile use not interfere with caribou migrations.

Local ridges, particularly Frisby, should not be promoted as destination areas for winter recreationists until the conflict with caribou use has been resolved. Many areas exist within 50 km of Revelstoke, some not occupied by caribou, which could be developed and promoted without major resource conflicts. Any alternative that diverts snowmobilers into areas not occupied by caribou and reduce the levels of use on caribou ranges should be examined.

The Revelstoke Snowmobile Club and the Cross-Country Ski Club should, as a condition of their SUP's, be required to keep a record of users in their facilities that could be provided to the Ministry of Environment and Parks on request. Additional snowmobile user information on Frisby Ridge should also be collected to assist in determining acceptable levels of use when the partial closure proves successful.

An impartial third party, acceptable to both the users and the Ministry of Environment and Parks, should be contracted to monitor caribou use on Frisby and Boulder Ridges to ensure compliance and success. If caribou continue to use only the northern parts of Frisby during the next two winters, then I would recommend that the south ridge also be closed. If caribou re-establish use on the south end, snowmobile use, at an acceptable level, could again be permitted on the entire ridge.

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Appendix A.

QUESTIONS ? CONTACT

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837-3723

PLEASE SIGN IN FOR <u>EVERY</u> OUTING!

We wish to determine the number of snowmobilers using this ridge <u>each week</u> and the response of caribou. If you saw caribou today, please leave your name and number. We may contact you.

<u>THANK YOU</u> FOR YOUR ASSISTANCE !

DATE	ADDRESS	NUMBER IN PARTY	HOW OFTEN DO YOU USE THIS AREA	HOURS ON RIDGE	DID YOU SEE ANY CARIBOU	NAME PHONE
JAN 10	REVELSTOKE	4	1 / WK	10 - 3	YES - 3	KEITH 837-3723

Wildlife Working Reports should not be cited because of the preliminary nature of the data they contain

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WR-10 Home on the range: how to cook an urban goose. W.T. Munro, R.T. Sterling, and M.D. Noble. February 1985. 19pp.

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WR-23 Critical habitats of caribou (*Rangifer tarandus caribou*) in the mountains of southern British Columbia. K. Simpson, K. Hebert, and G.P. Woods. February 1987. 13pp.

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